The Bluedisk project: searching for footprints of gas accretion

Jing Wang (KIAA)

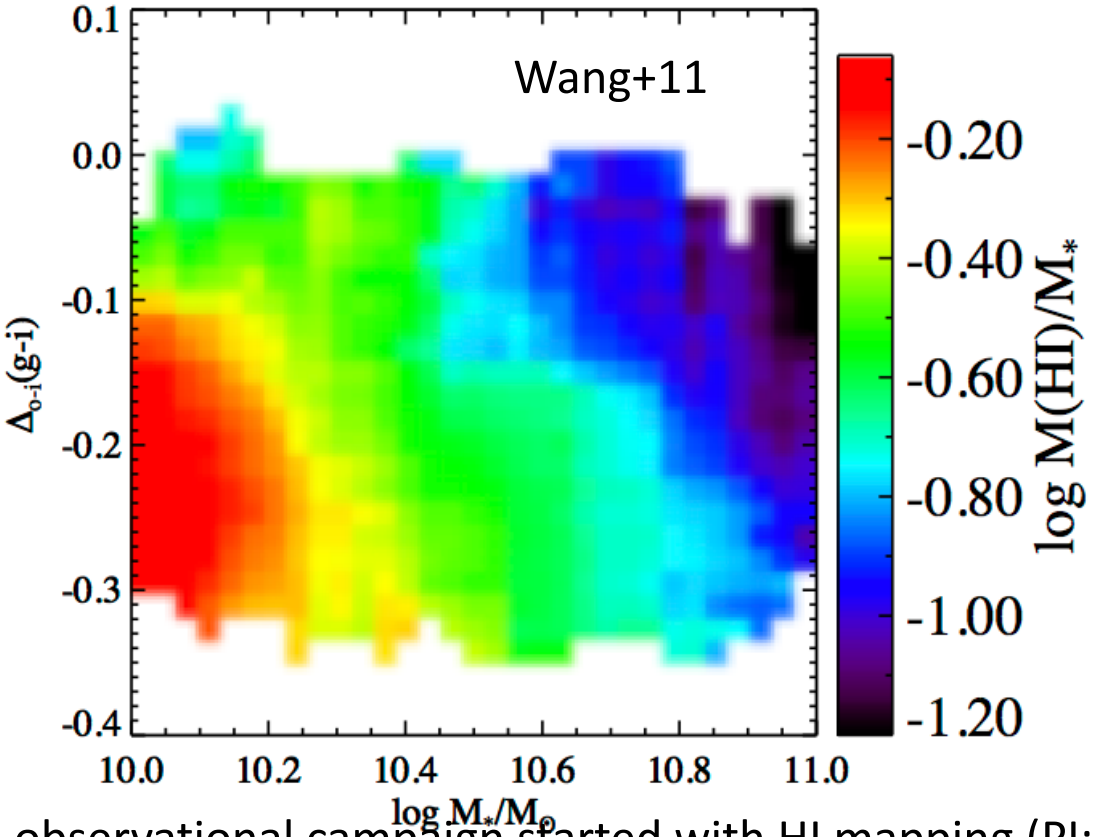
jwang_astro@pku.edu.cn

ASTRON, 2018

The Bluedisk project

Goal: searching for signs of gas accretion in and around HI-rich galaxies

The origin of "Bluedisk": HI-rich galaxies are on average bluer on their outer regions



An observational campaign started with HI mapping (PI: G. Kauffmann), and followed up by CO mapping (PI: F. Bigel) and optical long-slit spectroscopy (PI: J. Brinchmann).

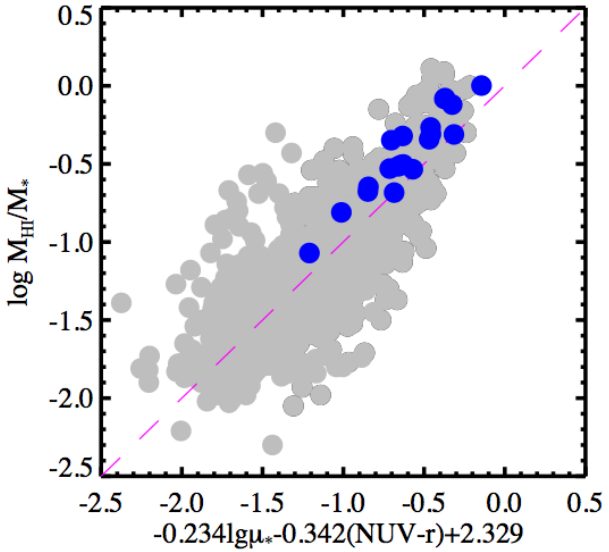
Collaborators:

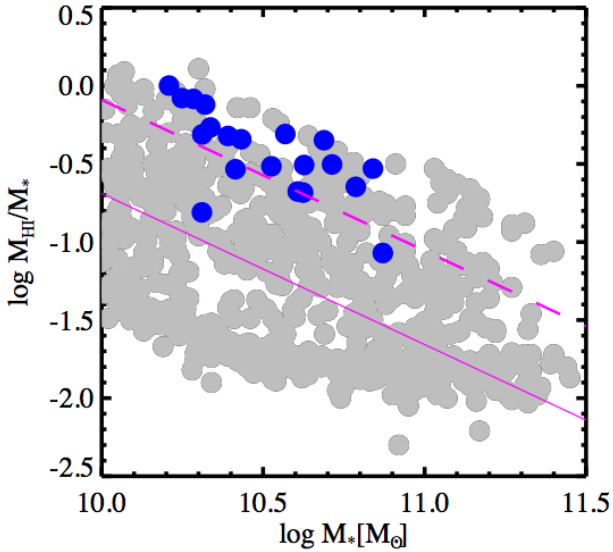
F. Bigiel (ITA/Heidelberg Univ.)
J. Brinchmann (Leiden)
D. Carton (Leiden)
M. den Heijer (Bonn)
J. Fu (MPA/SHAO)
K. Gereb (ASTRON)
G. Kauffmann (MPA)
M. L. Huang (MPA)
G. Jozsa (ASTRON)
C. Li (SHAO/THU)
T. Oosterloo (ASTRON)
S. Roychowdhury (MPA)
P. Serra (ASTRON/ATNF)
T. van der Hulst (RUG)
M. Verheijen (RUG)
E. Wang (SHAO/USTC)
J. Wang (MPA/ATNF/KIAA)

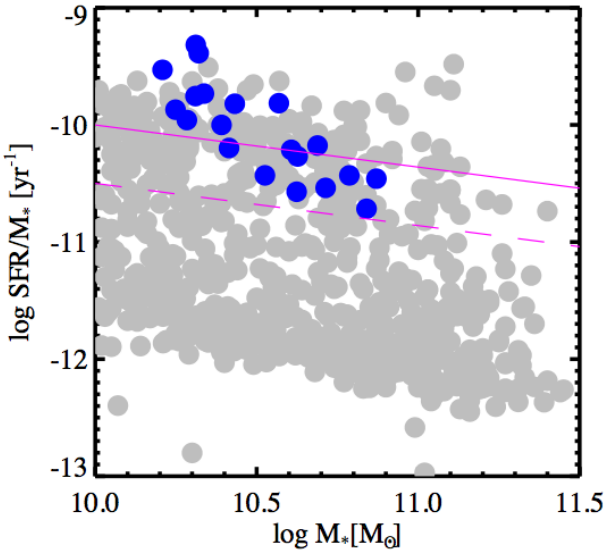
The sample

Sample: log M_*/M_{sun}~10-11, z~0.023-0.03 (Dis>100 Mpc)

- 23 HI-rich and 19 control galaxies that are relatively isolated (no major merger companion within 100 kpc)
- 8 interacting systems.

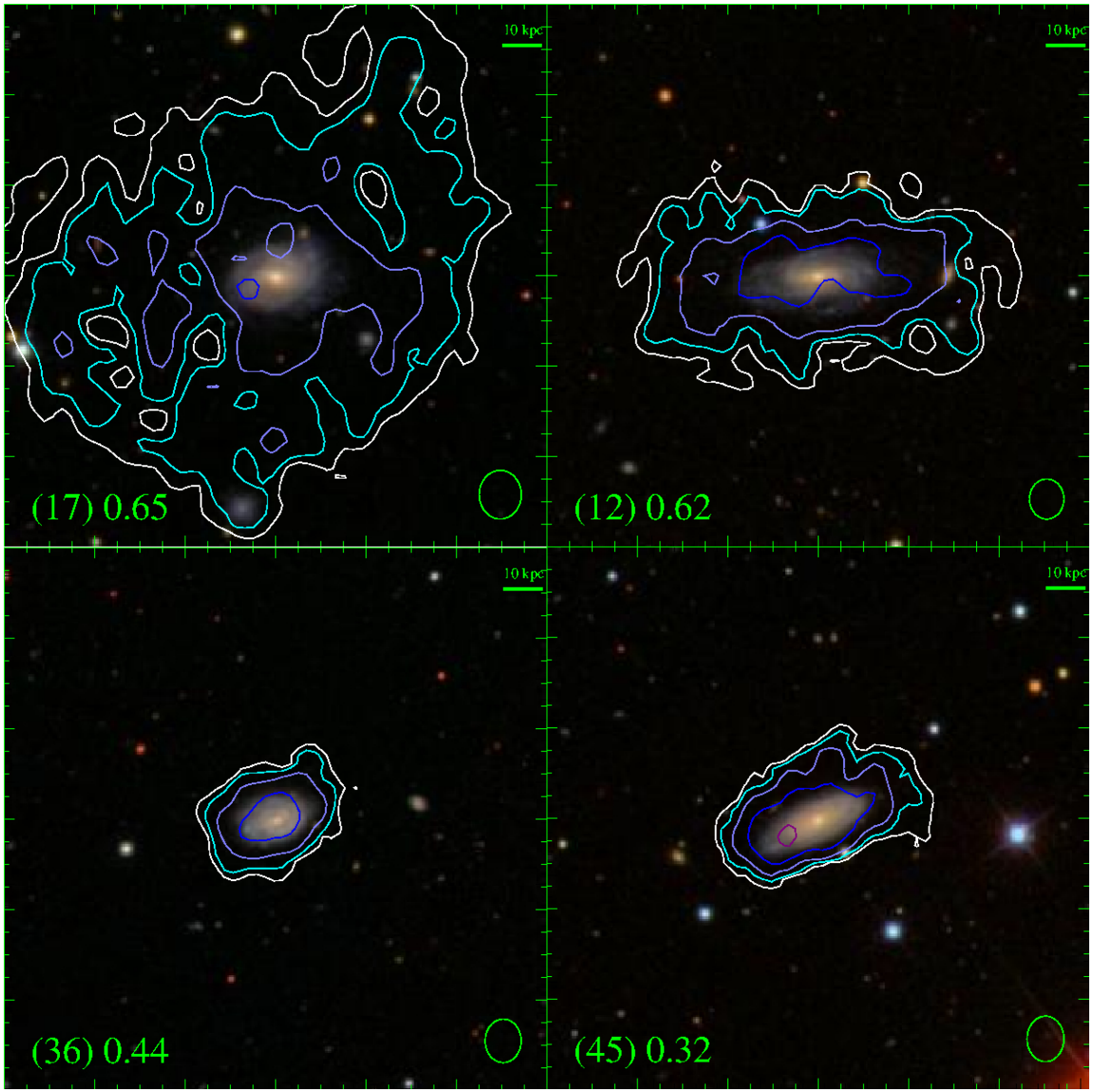






Wang+13

The HI data



WSRT observation

PSF~25 arcsec (10 kpc)
Depth:
point sources~10^8 M_sun
surface density ~0.5*10^{20} cm^{-2}

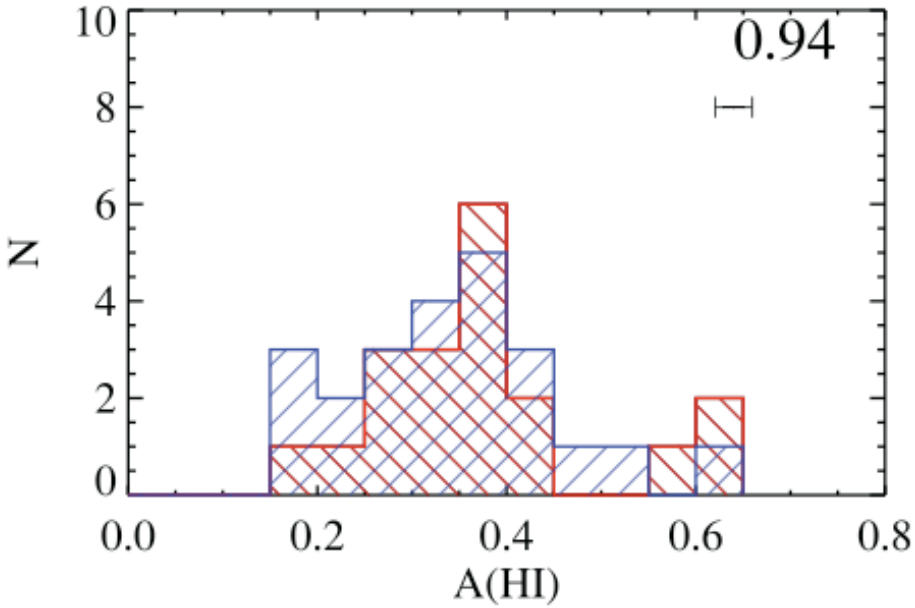
Field-of-view: 1 deg (~2 Mpc)

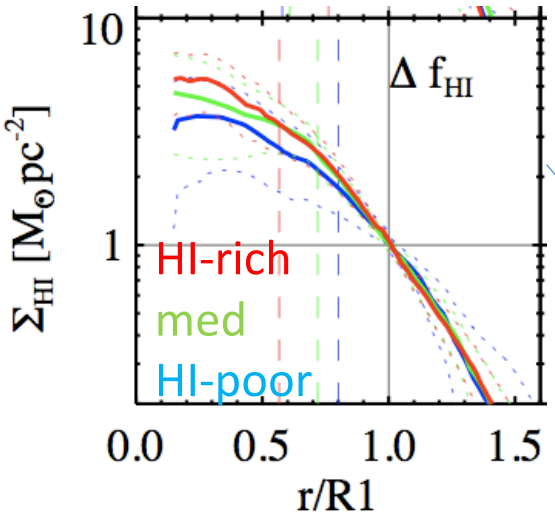
Data available:
http://www.mpa-garching.mpg.de/GASS/Bluedisk/index.php

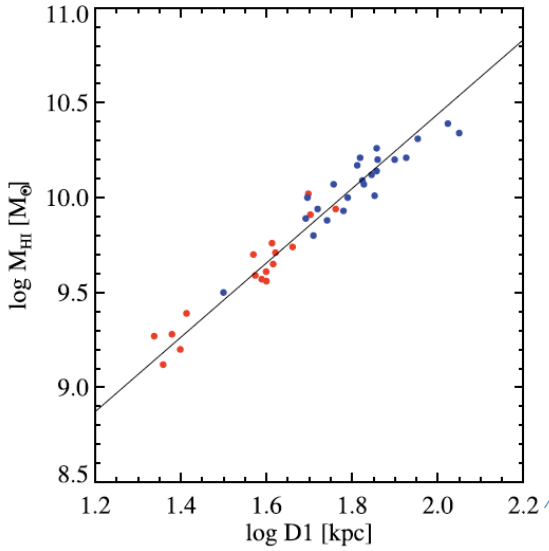
Wang+13

Structure of the HI-rich galaxies

We compare HI-rich to control:







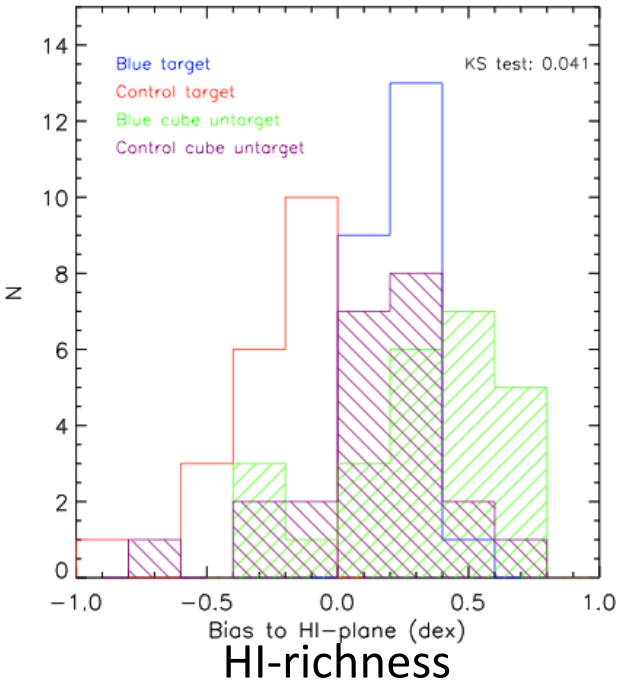
Fully reproduced by the Fu+ SAM model in Wang+14

The HI-rich galaxies are similar to or even less disturbed than the control galaxies (Bluedisk-WSRT, Wang+13, 14)

Conformity in HI-richness

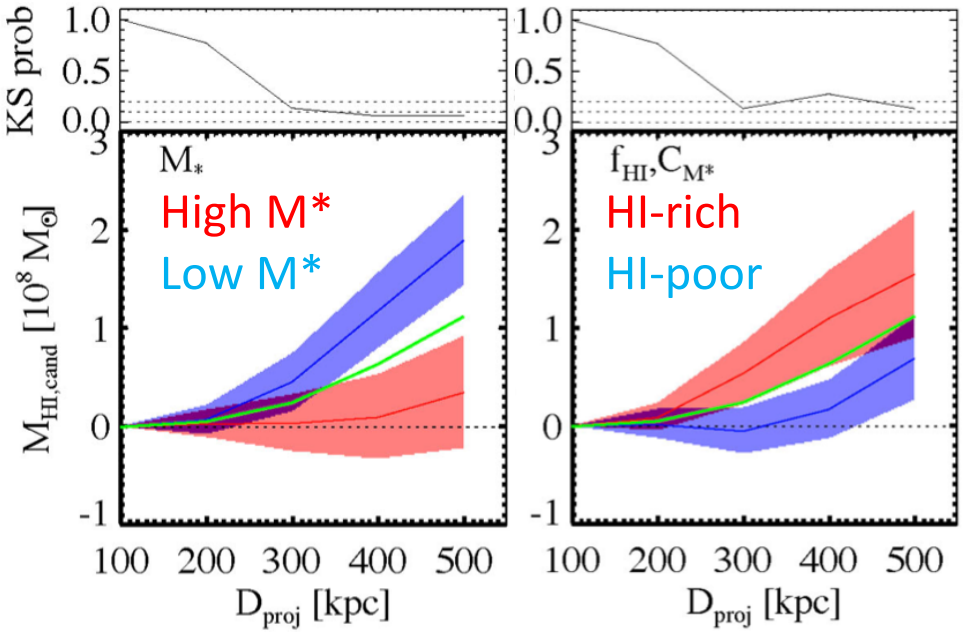
In satellites(Bluedisk-WSRT, E. Wang+15)

HI-rich central
Control central
Satellites around HI-rich central
Satellites around control central



HI-richness

Signal cumulated outside detectable sources (Bluedisk-WSRT, J. Wang+15)



A common underlying reservoir of gas for both central and satellite galaxies

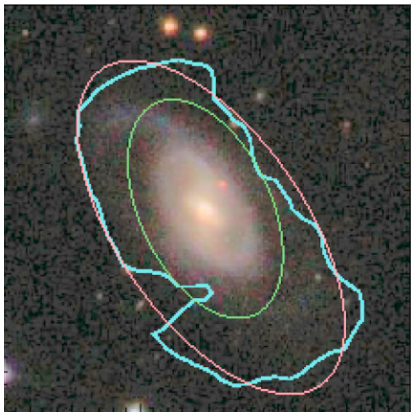
Inconformity in HI disc structure

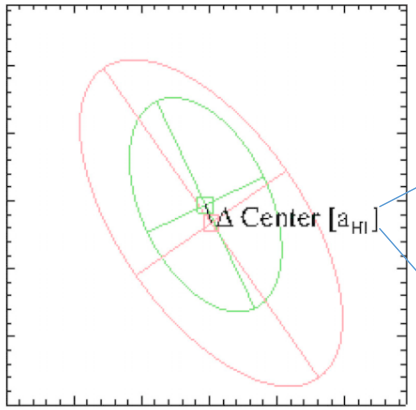
HI-rich central

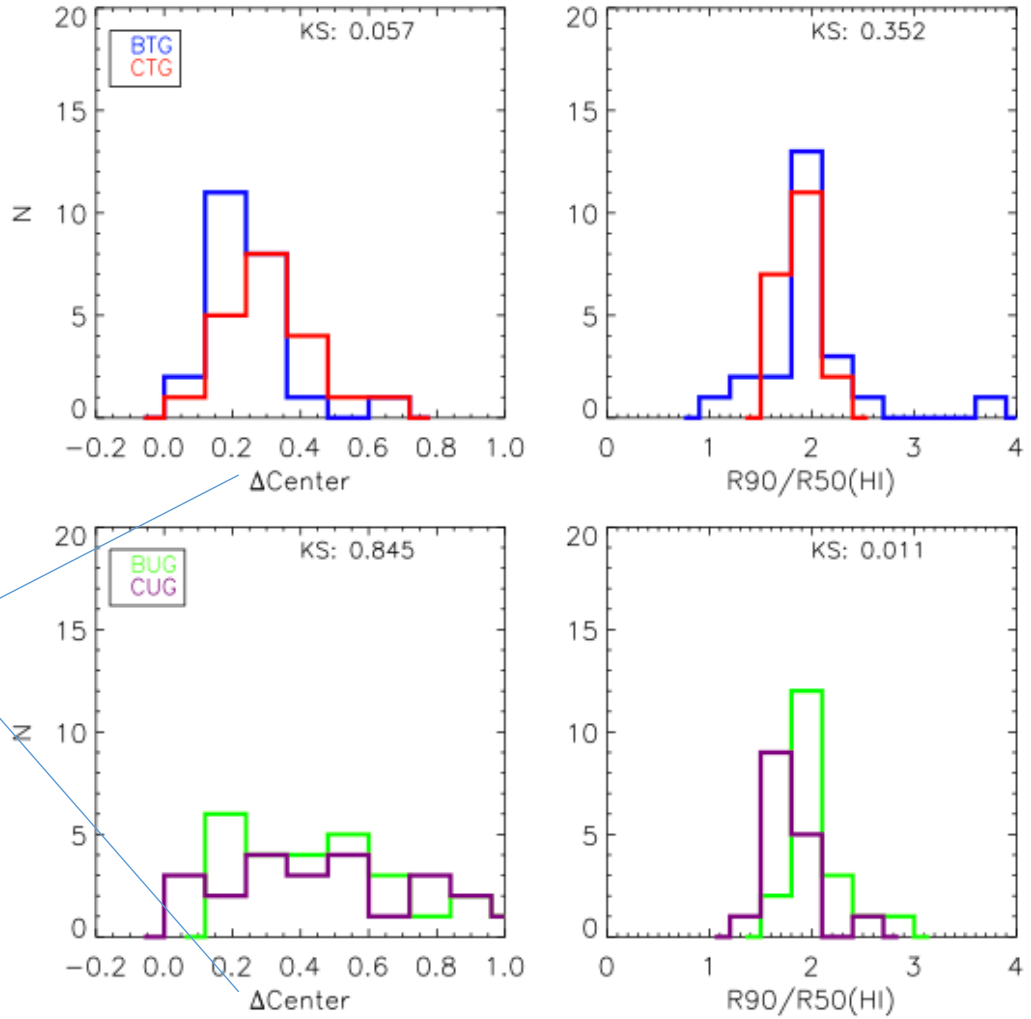
Satellites around HI-rich central

Control central

Satellites around control central



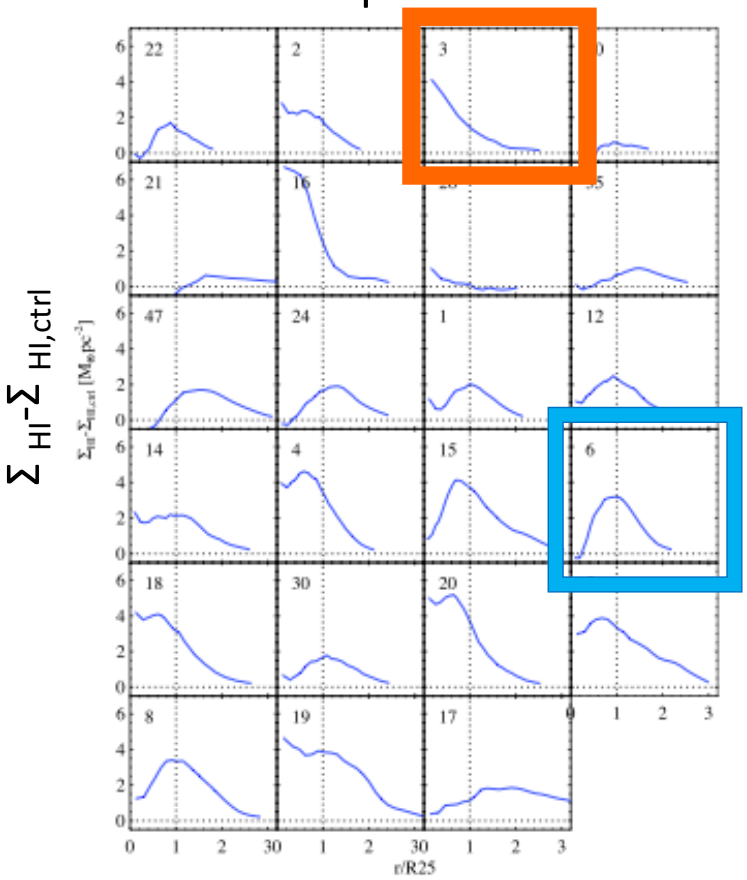




Satellites around HI-excess and normal centrals show considerable difference in morphology of HI discs. (Bluedisk-WSRT, E. Wang+15)

HI-excess and H_2 radial distributions

HI radial profile of HI-rich galaxies - <control radial profile>:

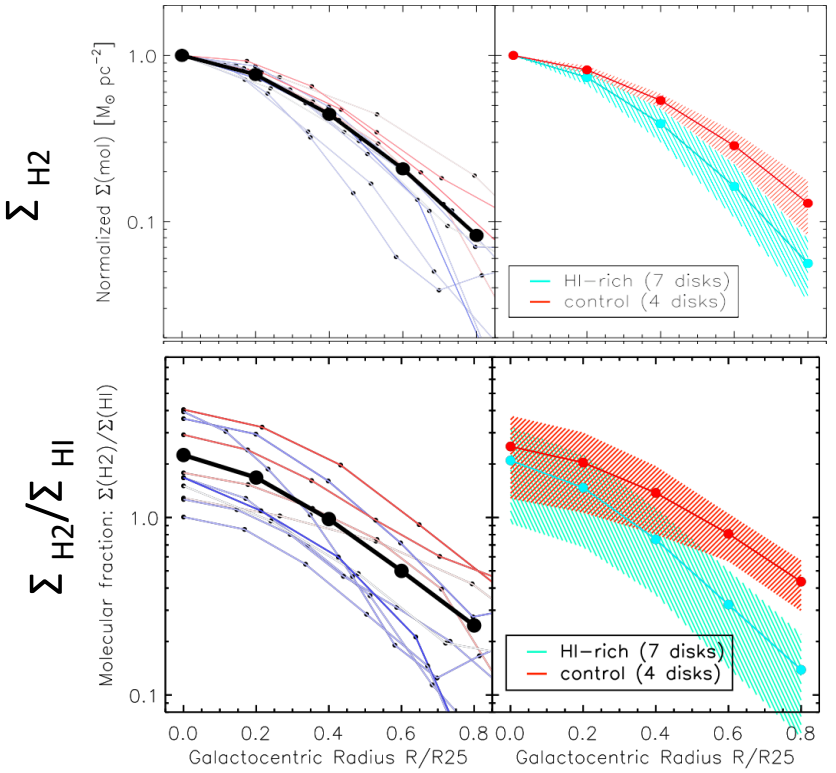


$\Sigma_{HI}-\Sigma_{HI,ctrl}$

r/R25

(Bluedisk-WSRT, Wang+14)

Molecular disk: (Bluedisk-IRAM, Cormier+16)



Σ_{H2}

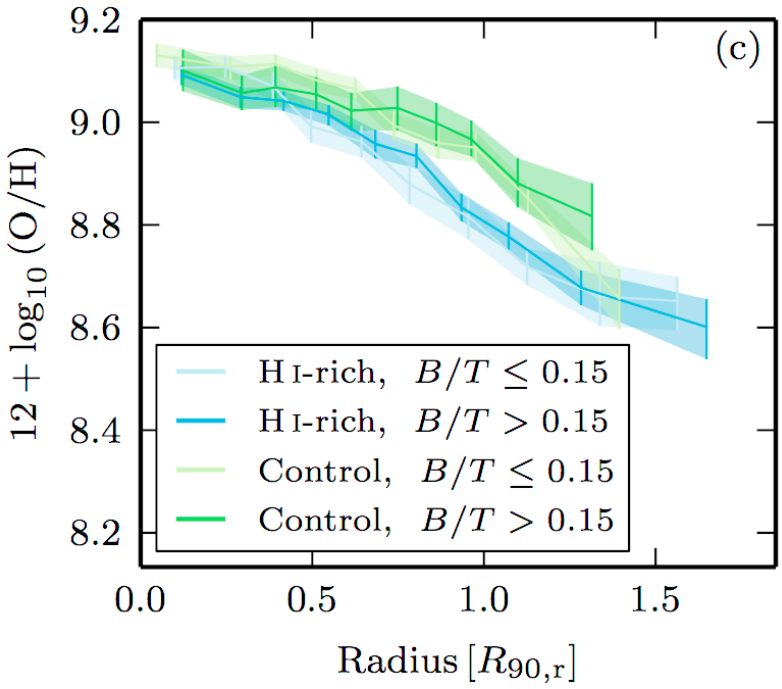
Σ_{H2}/Σ_{HI}

r/R25

The three smallest H_2 disks all have excess HI distributed near r25

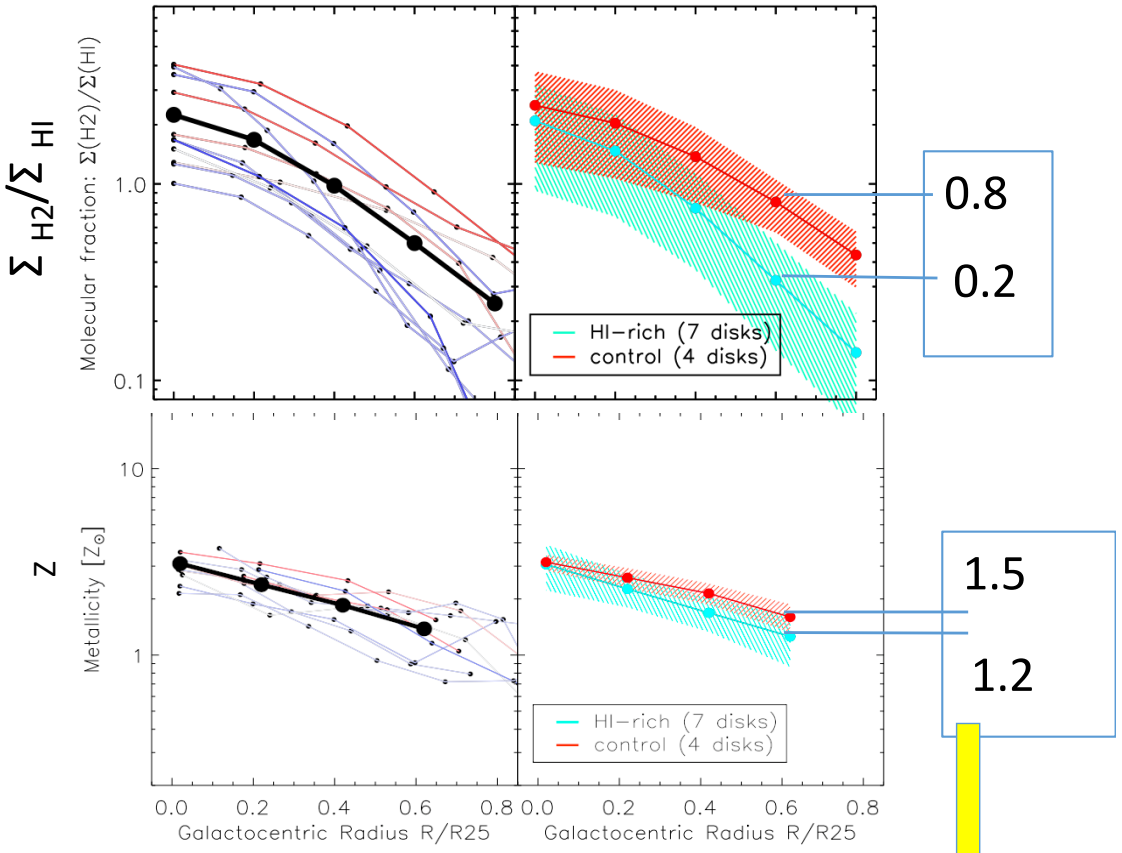
Metallicity and H_2 radial distributions

Metallicity (Z) gradients:



(Bluedisk-WHT, Carton+15)

Molecular disk:



r/R25

(Bluedisk-IRAM, Cormier+16)

H_2/HI~ 0.8 0.7

(Krumholz+13 model)

Summary

What has gas accretion possibly done to low-redshift, high-M_* and HI-rich disc galaxies?

- Built an HI-rich environment extending to ~Mpc distances.
- Put excess HI at the center for some galaxies, and near the disk edge for other galaxies.
- Produce a steep metallicity drop toward the outskirt.
- Keep the molecular disks unchanged or possibly make them shrink.
- Make blue outer disks.